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Science and Technology Perspectives

DEVELOPMENTS

Artificial Blood

(USSR) Chemists at Moscow State University are conducting research on stable emulsions which has application in the development of artificial blood. The emulsions contain perfluorodecalin (PD), which can transport oxygen and is nontoxic. Soviet chemists have added sodium desoxycholate, a biologically active steroid surfactant, to improve the emulsion's stability and enhance dispersion. (Moscow VESTNIK MOSKOVSKOGO UNIVERSITETA: SERIYA 2, KHIMYA Vol. 27, No. 5, Sep-Oct 86) Kris P. X2898

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The National Space Development Agency (NASDA) has proposed modifying the H-II booster to increase the rocket's payload capacity and versatility.

USSR: Possible High-Tech Uses for New Compounds Page 5

Soviet scientists are conducting research to determine the suitability of metallofluoride compounds for use in lasers and electronic components.

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Spain is expanding its high-tech industrial base and increasing its participation in European R&D programs.

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PERSPECTIVES selections are based solely on foreign press, books and journals, or radio and television broadcasts. Some of the source materials used in this publication will appear as abstracts or translations in FBIS serial reports. Comments and queries regarding this publication may be directed to the Managing Editor (Craig M.) or to individuals at the numbers listed with items.

STAT

FOR OFFICIAL USE ONLY**DEVELOPMENTS**

DEVELOPMENTS highlights worldwide S&T events reported in the foreign media. Items followed by an asterisk will be published by FBIS. The contributor's name and telephone number are provided.

- Agrotechnology** (Hungary) A new chemical that retards soil moisture loss and controls seepage has been developed by the Budapest Chemical Works. Called "Evagro," the compound is a mixture of surface-active chemicals (not further identified) that are added to the soil prior to planting. In experimental applications, the compound increased crop yield by an average 11.3 percent. Use of the product could mitigate the impact of a current severe drought in Hungary. (Bonn DIE LANDWIRTSCHAFT DES OSTBLOCKS 6 Nov 86) Sari P. X2907
- Computers** (Czechoslovakia/Romania) The Czechs have signed an agreement with Romania for joint R&D in the areas of electronic components and computer technology. The Czechs will focus on computer graphics equipment, testing equipment, and minicomputers while the Romanians will concentrate on visual display terminals and peripheral storage subsystems. (Prague RUDE PRAVO 20 Nov 86) Craig M. X2145
- Factory Automation** (FRG) Siemens has developed an audio sensor for robots that manipulate objects. Ultrasonic waves are emitted by an echo sounder, reflected back to the sensor by objects in the robot's work space, and processed by a computer in less than one-hundredth of a second. Made of plastic and piezoelectric ceramic disks, the new sensor processes data faster and defines objects more accurately (about a one-tenth millimeter resolution) than currently available sensors. (Frankfurt/Main FRANKFURTER ZEITUNG/BLICK DURCH DIE WIRTSCHAFT 28 Nov 86) Eva L. X2519
- New Materials** (Japan) The Ministry of International Trade and Industry (MITI) has allocated 3.9 billion yen in 1987 for the Next Generation Industrial Key R&D System. Technologies in this program include fine ceramics (the most heavily funded with 1.2 billion yen), high-performance polymeric separation film materials, high-conductivity molecular materials, high-quality crystal control alloys, composite materials, and optical reaction materials. MITI's New Materials Enterprise Survey shows that of the 186 Japanese firms to recently begin new materials R&D, the largest segment (37 percent) is working in the fine ceramics area. (Tokyo NIKKAN KOGYO SHIMBUN 23 Sep/3 Nov 86) Junko A. X2726
- (Japan) The Mitsui Toatsu company has improved the production process for heat-resistant polyimide resin. The company acquired the original technology from NASA in 1984 and has concentrated on exporting the resin to US aerospace firms.

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The new Mitsui Toatsu process, which reduces production cost and improves quality, has resulted in the development of over 20 new grades of resin that the firm hopes to sell to electronics and composite materials manufacturers. (Tokyo KAGAKU KOGYO NIPPO 20 Oct 86) Junko A. X2726

(Japan) The Mazda Motor Company and the firm NGK have announced completion of a joint program to develop and market the first ceramic swirl chamber for a diesel engine. Made of heat-resistant silicon nitride, the chamber is 30 millimeters in diameter and 40 millimeters in length. The chamber allows complete fuel combustion and tolerates heat up to 1,000°C, thereby reducing emission of sulfur oxide and carbon particulates to one-third that of conventional swirl chambers. The firms plan a monthly production schedule of 3,000 to 4,000 ceramic swirl chamber-equipped diesel engines for sale to the US Ford Motor Company. (Tokyo NIKKAN KOGYO SHIMBUN 17 Oct 86)* Akiko S. X2726

Nuclear Energy

(Hungary/USSR) Process control systems for CEMA nuclear power plants will be developed under an agreement between Hungary and the USSR. Joint research teams will be formed in which 20 Hungarian scientific institutes and enterprises will participate. The equipment reportedly will be produced using flexible manufacturing systems (FMS). (Budapest MAGYAR HIRLAP 28 Nov 86) Sari P. X2907

X-Ray Lithography

(FRG) The Berlin Electron Storage Ring Company for Synchrotron Radiation has developed COSY (Compact Storage Ring for Synchrotron Radiation), a machine that reportedly will enable the economical production of microchips using X-ray lithography to reduce microstructure line width. COSY simultaneously treats several wafers at a time. The machine will be marketed by COSY Microtec at a price of DM20 million per unit. (Zellik TECHNIVISIE 19 Nov 86; Munich ELEKTRONIK 17 Nov 86) Antwerp Unit/Eva L. X2519

FOR OFFICIAL USE ONLY**JAPAN: PROPOSED BOOSTER MODIFICATION**

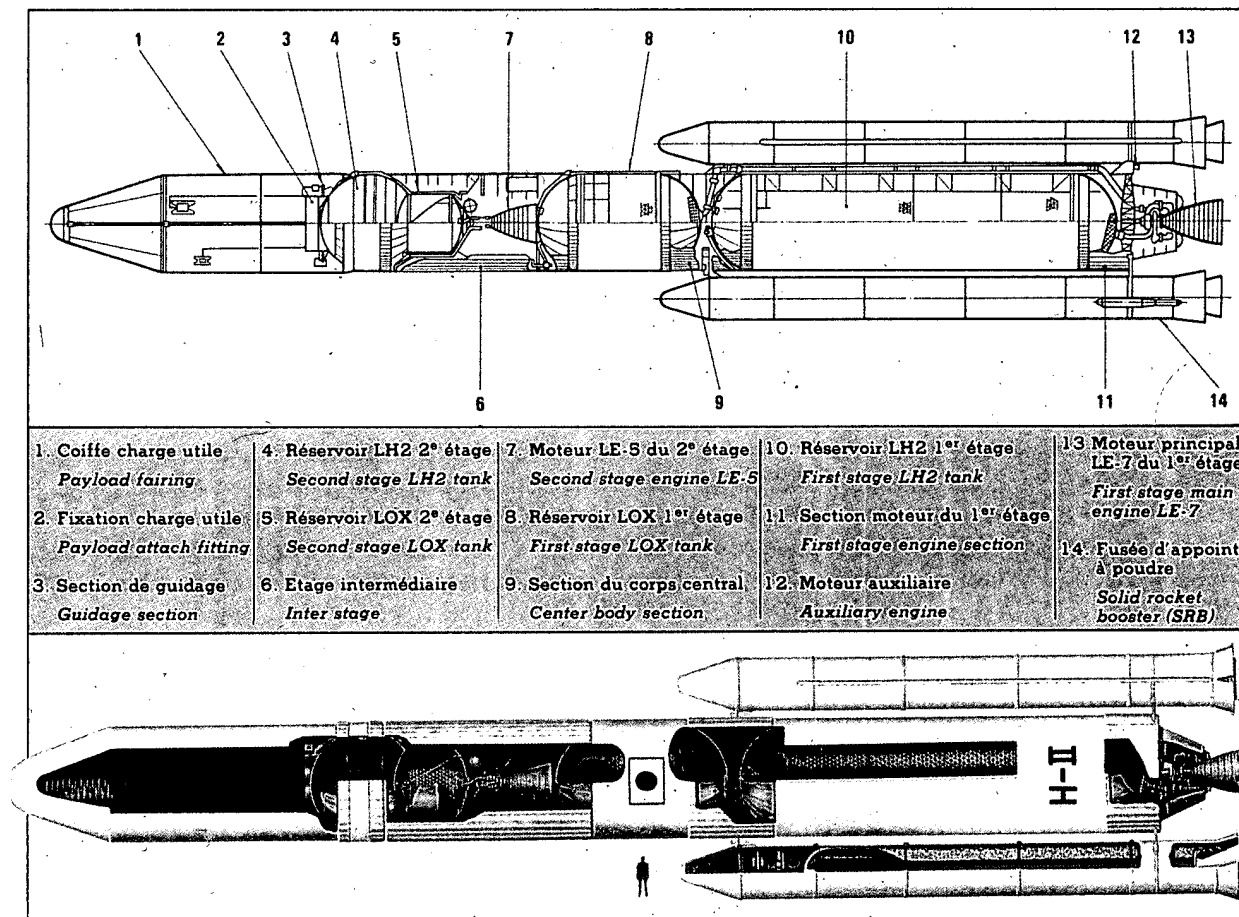
Key Points: Japan's National Space Development Agency (NASDA) has announced plans to modify its prototype H-II rocket booster in order to increase the rocket's payload capability and versatility. Although the initial launch of the H-II is scheduled for 1991, the modifications will not be integrated into the booster design until the middle of the decade, according to a 30 October report in NIKKEI SANGYO SHIMBUN.

NASDA has proposed four alternative H-II booster modification packages that draw primarily upon existing technologies to minimize development costs, accommodate diverse payload requirements, and give the rocket a 3g launch acceleration (equivalent to that of the US space shuttle). The first design plan calls for equipping the H-II with six solid rocket boosters (SRBs), instead of the present twin-SRB design. This modification would allow the rocket to carry 3-ton satellites into geosynchronous orbit (the H-II currently is limited to a 2-ton payload) and 10-ton cargoes to a low-altitude space station.

A second approach envisions the attachment of two liquid oxygen-hydrogen boosters to the liquid oxygen-hydrogen main LE-7 engine. This configuration would give the H-II the capacity to carry a 5-ton satellite into geosynchronous orbit or to deliver 24 tons of cargo to a low-altitude space station. Although the design draws upon existing technology, the launch site at Tanegashima would have to be expanded to accommodate increased fuel storage.

NASDA's third design scenario would require the development of a booster that relies on hydrogen-based fuel. NASDA is considering either petroleum-derived RJ1 fuel, currently used in the first stage of the H-I rocket booster, or methane. The Tanegashima facilities would not have to be altered because a hydrogen-based fuel engine would have lower thrust than a pure liquid hydrogen engine. However, modifications in the fuel to accommodate new thrust requirements reportedly would involve large R&D expenditures. This design would enable the H-II to carry 6-ton satellites into geosynchronous orbit and 34-ton cargoes to a low-altitude space station.

The fourth approach calls for the development of a liquefied air cycle engine (LACE) and would capitalize on rocket engine research at Mitsubishi Heavy Industries. Although specifications are currently unavailable, the engine reportedly would allow maximum payload weight using a smaller rocket. Many Japanese experts believe that the LACE may be an intermediate step in the development of a spaceplane.

FOR OFFICIAL USE ONLY*The H-II booster rocket*

Mitchy E. X2726

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USSR: POSSIBLE HIGH-TECH USES FOR NEW COMPOUNDS

Key Points: Soviet chemists are investigating metallofluoride compounds for potential applications in laser, optical, and electronic devices, according to studies published in ZHURNAL NEORGANICHESKOY KHIMII (Sep 86).

Scientists at the Institute of Chemistry im. V.I. Nikitin, Academy of Sciences, Tadzhikskaya SSR, are researching metallofluoride systems like $\text{LnF}_3\text{-CoF}_2$ ($\text{Ln}=\text{Gd, Tb, Dy, Ho, Er, or Tm}$) to determine their optical, electrical, and magnetic properties.* Rare earth oxides have been shown to combine ferroelectric or antiferroelectric properties with a magnetic polarity that remains constant even at very low temperatures. As a result, rare earth oxides have a range of potential uses in high-technology industries. The current Soviet experiment, however, is the first to produce antiferromagnetic alloys of cobalt fluorides and rare earth elements as possible precursors to the development of materials with particular magnetic, optical, and magneto-optical properties.

The researchers analyzed the alloys using thermal gradient, crystallo-optical, and X-ray diffraction methods. The $\text{LnF}_3\text{-CoF}_2$ ($\text{Ln}=\text{Tb, Dy, Ho}$) systems are simple eutectics with bounded solid CoF_2 solutions. The $\text{LnF}_3\text{-CoF}$ ($\text{Ln}=\text{Gd, Er, Tm}$) systems are eutectic with a nonvariant, secondary eutectic between the liquid phase and the heat-modified rare earth trifluoride. The studies claim that these compounds can be used in the development of crystals for lasers.

In other metallofluoride research, chemists at Moscow State University are studying the formation of PbF_2 , Pb_2F_4 , and PbF gases. The Soviet experiment was designed using PbF_2 research results published in the JANAF Handbook and Ge_2F_4 theoretical research conducted by Canadian chemists. The Soviets used the Knudsen effusion method with mass-spectral analysis of the vaporization products to determine the enthalpy of a reciprocal high-energy reaction in which Pb_2F_4 (gas) yields 2PbF_2 (gas), producing 178.7 kJ/mol at a temperature of 298°K at standard pressure.

*Ln is a generic designation for the lanthanide series.

Kris P. X2898

FOR OFFICIAL USE ONLY**SPAIN: EMPHASIS ON HIGH TECHNOLOGY**

Key Points: The Spanish Government is increasing its funding of public high-tech industries and is encouraging private firms to participate in national and European science and technology programs. The government's goal is not only to become a major participant in advanced technology R&D but, where possible, to assume a leadership role, according to December reports in the Madrid press.

Madrid is pursuing its national high-tech campaign through direct project funding, through the establishment of joint ventures with foreign firms, and through the promotion of R&D spending by local governments. On the national level, Madrid is considering the allocation of \$220 million for a second National Electronics and Information Technology Plan (PEIN II). The plan is designed to modernize Spain's data storage, retrieval, and transfer capabilities using a data system that would integrate leading-edge technologies in information and computer science. The plan, however, is embroiled in a controversy between the Ministry of Industry, which argues the plan's merits as a means of acquiring foreign technology, and the Ministry of Finance, which contends that the cost of implementation would be prohibitive.

Madrid has launched a joint venture with the Eurotechnology company, an affiliate of the US firm Dyne-Sem, to build an R&D center for the study of chip packaging and a plant for packaging chips in ceramics. In addition, the government hopes to use the facility to train Spanish engineers and as a conduit for introducing into Spain sophisticated technologies such as machine vision for chip fabrication. Of the \$16 million that will be needed to build the complex, Eurotechnology has raised \$2.6 million, with the Ministry of Industry extending \$5.4 million in credit.

On the local level, the government of Valencia, motivated by Madrid's push to develop a high-tech industrial base and the need to revitalize a sagging regional economy, will build the country's first technology park. With ground breaking slated for early this year, the park will cost \$86 million and have 9 million square feet of floor space. Valencia will contribute \$26 million with the remainder to come from private firms involved in metalworking, ceramics, and biotechnology. By arrangement with the provincial government, private firms associated with the park will annually reinvest 3 percent of their sales revenues in park R&D activities.

The Spanish Government also has taken an active role in the European R&D programs EUREKA and ESPRIT. Madrid is participating in 14 EUREKA projects and Spanish contributions total \$156 million or 21 percent of the program's budget. The table below shows several key projects in which Spain is involved.

| PROJECT | SPANISH PERCENTAGE OF TOTAL | SPANISH FIRM INVOLVED |
|--|-----------------------------------|--------------------------|
| Advanced Mobile Robots | 17 | CASA |
| EUROCIM (flexible automated factory for electronic circuits) | 20 | Inisel |
| BD-11 (development of data base for expert systems) | 27 | Entel |
| European Software Factory | 6 | Sofemasa |
| Diane (use of neutronography in quality control of components manufactured from new materials) | 10 | Sener |
| Computerized Engineering | 22 | Sereland |
| Galeno-2000 (automated noninvasive medical diagnostic equipment) | 40 | IDS |
| Europolis (intelligent traffic control system) | 40 | IDS |

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A participant in ESPRIT since 1984, Madrid currently contributes 5 percent of the program's budget and plans to double this figure by 1988. The Spanish firms O Dati Espanola SL, Sofemasa, CCS-SCYT, CITSA, and MAPS Informatica Industrial, the University of Santiago de Compostela, and the Polytechnic of Catalonia are involved in ESPRIT projects that focus on signal processing systems and software packages. As part of Spain's expanding role in ESPRIT, 10 Spanish firms (not further identified) have tendered \$15 million in bids on several projects scheduled to begin in 1987.

Nate D. X2676

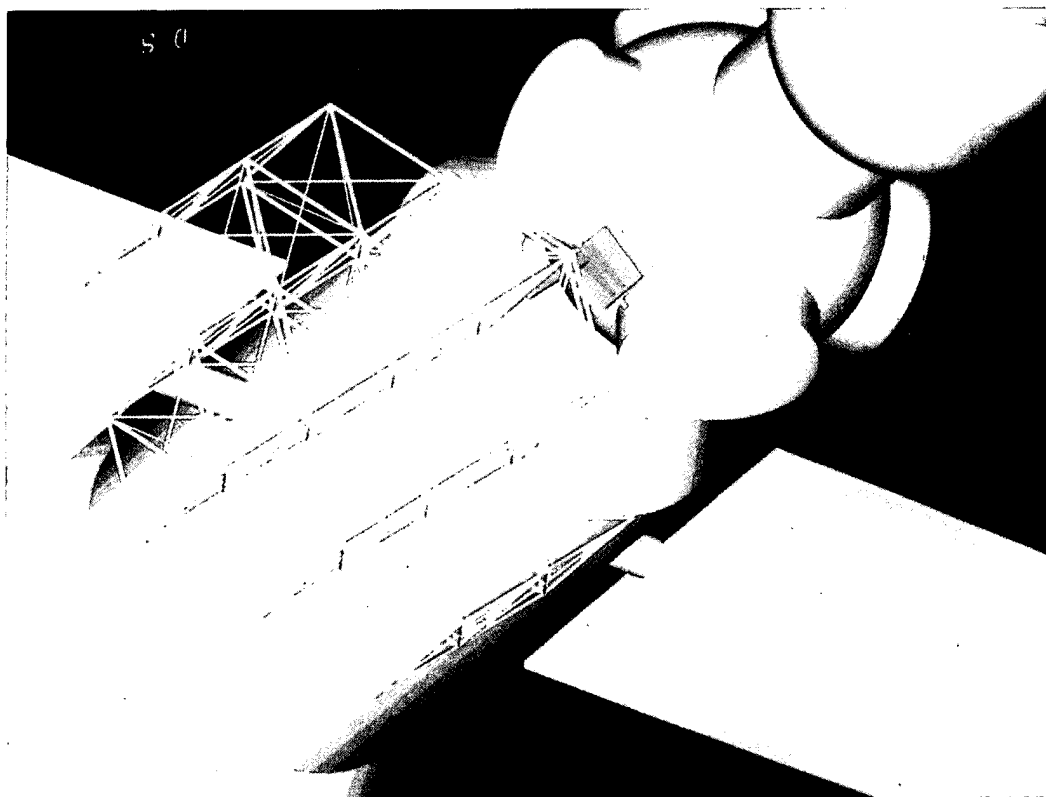
FOR OFFICIAL USE ONLY**REPORTS**

REPORTS surveys science and technology trends as detailed in articles, books, and journals. It also includes summaries and listings of articles and books which may serve as potential sources for future research. Conference proceedings will occasionally be presented in this section.

USSR/France: MIR EXPERIMENTS

Aerospatiale of France, under contract to the CNES (National Space Studies Center), is preparing two experiments for the joint Soviet-French Mir mission scheduled for 1988, according to reports in AIR & COSMOS (13 Dec) and AEROSPATIALE (Dec-Jan).

A lattice structure, designated ERA, will be deployed from the exterior of the Mir's forward docking compartment. In a six-hour extravehicular activity, French astronaut Jean-Loup Chretien will attach the experimental lattice structure between two of the station's docking ports. The structure is intended to support future 10-meter antennas for communications satellites and to support orbital station components. (For previous reporting on the mission, see SCIENCE AND TECHNOLOGY PERSPECTIVES Vol. 1. No. 14 p 1.) Made of carbon-fiber tubes with light metal alloy hinges, the lattice structure is 1 meter long by 0.6 meters in diameter when folded and 3.8 meters in diameter when fully deployed. After Chretien attaches the lattice to a mounting device, the crew will deploy the structure by remote control, using accelerometers to measure structural vibration. The structure will be jettisoned after the experiment.



Computer Graphic of Deployed ERA Lattice

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A second experiment conducted inside the Mir will test a model of the AMADEUS, a new deployment mechanism for future solar arrays. Deployable in two or three dimensions, AMADEUS consists of four arms, each measuring 1.3 by 0.8 meters and articulated by a new type of hinge (not further described). The Mir crew will measure the mechanism's deployment kinematics using two miniature infrared cameras to record motion coordinates. Measurements will be made during a series of 10 tests (with each test repeated three times).

Eva L. X2519/John C. X2725

FOR OFFICIAL USE ONLY**FRANCE: VHSIC DEVELOPMENT AND PRODUCTION**

Thomson has started a program called CITGV for the development and production of very high speed integrated circuits (VHSICs). VHSIC technology is regarded as vital not only to France's defense establishment but as a source of spinoff technologies for the civilian sector, according to AIR & COSMOS of 15 November.

The program is using bipolar and CMOS technologies to develop the circuits. Thomson's Signal Processing Working Group is developing four high-speed bipolar VHSICs for radars: a fast Fourier transform operator, a systolic filter, and SIMD (single instruction multiple datastream) and MIMD (multiple instruction multiple datastream) operators. Thomson's Military and Space Division (DMS) has announced that the first circuits will be delivered to equipment manufacturers by the end of 1987.

One of the VHSICs is a 24-bit-by-24-bit multiplier that employs STL (Schottky Transistor Logic) with three metallization layers. The propagation time is 40 nanoseconds with a power consumption of 200 microwatts per logic gate. The feature size currently being achieved for these circuits is 2 microns. DMS hopes to reduce the feature size to 1.25 microns, which will allow 35,000 logic gates on a one-square-centimeter chip and a propagation time of around 1 nanosecond at a frequency of 50 megahertz.

The bipolar chips are mounted on a special package called an OVCC (open via chip carrier), on which high-performance automated soldering machines attach 228 leads in several staggered rows.

Thomson's Study Group on Signal Processing in cooperation with ESD (Electronique Serge Dassault), which is the prime contractor, TRT (Radio and Telephonic Telecommunications), and CSEE (Signals and Electric Ventures Company), is developing CMOS technology for the VHSICs. The first phase of this program calls for the creation of CMOS circuits 2 microns in size with two metallization layers. The second phase involves development of 1.25 micron circuits with two metallization layers. Thomson is also developing production processes to accommodate the new circuits. In addition, the firm is building a "library" of standard cells that will facilitate the manufacture of circuits having more complex functions, and researchers plan to use silicon compilers to further miniaturize circuit features. Other programs will design test and packaging methods.

Sharon W. X2519

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FRANCE: MOLECULAR BEAM EPITAXY

France has made advances in the field of molecular beam epitaxy or MBE (a technology critical to the manufacture of microelectronic chips), as a result of R&D programs being conducted by the electronics firms Picogiga and Riber to automate and accelerate the MBE process, according to articles in the Paris press and a report in the AGRA data base.

Picogiga plans to begin production of one- to two-micron-thick epitaxial layers on gallium arsenide wafers. The firm also has designed an MBE machine (not further described) that produces an epitaxial layer in a half hour. The components are designed for use in transistors, integrated circuits, and other advanced electronics (not further described) reportedly with SDI applications. Picogiga is concentrating its R&D efforts on improving the quality of the epitaxial layer and on precisely controlling its structure.

Riber, which has been working in the MBE field for over 10 years, has concentrated its R&D efforts on process automation. Riber's MBE 32, the firm's most advanced industrial system to date, has a two- or three-inch revolving substrate holder and is equipped with a new system for mounting substrates into the holder. This machine allows faster and more efficient production of higher quality wafers. The firm currently is developing a modular MBE system that uses an IBM personal computer to load and process a large number of substrates. Ten to twenty substrates are simultaneously loaded into the first module of the system and automatically proceed to subsequent modules where they are outgassed (heated in a vacuum to remove gases or water vapor) and undergo MBE. Riber is also conducting research on a "unique" high-temperature cell for doping silicon substrates and on a larger, more durable cell for doping arsenic substrates.

Antwerp Unit/Eva L. X2519

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HUNGARY: INFORMATION NETWORK

Hungary's National Technical Development Committee (OMFB) has approved the establishment of a nationwide computer-based information network that will be accessible to institutes engaged in advanced technology R&D, according to a 9 December NEPSZABADSAG interview with Istvan Lang, secretary general of the Hungarian Academy of Sciences. A computer network connecting service bureaus with work stations will form the core of the system. Slated for completion by late 1990, the project calls for the installation of 800 to 1,000 work stations, 140 to 160 data terminals linked to the postal telecommunications system, and 100 to 200 data stations.

Of the 1.5 billion forints earmarked for the system, two-thirds will be spent on equipment while the remainder will fund the development of data base services (not further detailed). The funds will be allocated by the OMFB, the Academy of Sciences, and by various national agencies and institutions. An additional 400 million forints will be provided by the National Scientific Research Fund. Moreover, the government has allocated 800 million forints to establish special instrument centers.

Lang believes that the information system will promote cooperation between research and development groups and make possible the automation of precision measurement and other laboratory equipment. In addition, he sees the new network accelerating the establishment of domestic data banks, facilitating the documentation and publication of R&D work, and leading to closer international contacts through information sharing.

Sari P. X2907

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PREVIEWS

PREVIEWS is an annotated list of selected science and technology items being translated by FBIS. The list may also contain previously published items of wide consumer interest.

EUROPE/LATIN AMERICA REPORT: SCIENCE AND TECHNOLOGY

THOMSON R&D IN GALLIUM ARSENIDE MONOLITHIC ICs

A research scientist at Thomson Semiconductors outlines the firm's R&D activities in gallium arsenide monolithic ICs and high-speed digital devices. Thomson's use of optical lithography and electron beam direct writing in semiconductor production is also detailed. (Milan ALTA FREQUENZA May-Jun 86)

EMERGENCE OF BRITISH, FRENCH BIOTECHNOLOGY POLICY

Article reviews major trends in British and French biotechnology research and refers to an official report to be published in 1987 dealing with the two countries' national biotechnology policy. (Paris EUROPEAN BIOTECHNOLOGY NEWSLETTER 3 Dec 86)

ANALYSIS OF BULL'S TAKEOVER OF HONEYWELL INFORMATION SYSTEMS

Series of articles analyzes the strategy, financing, and risks involved in Bull's takeover of Honeywell's Data Processing Division. (Paris L'USINE NOUVELLE 11 Dec 86)

SCHEDULE, PRICE, TECHNICAL DETAILS ON AIRBUS A-330, A-340

Article examines development and certification schedule, price, and technical similarities/differences between the two aircraft, whose manufacture is slated to begin in March 1987. (Paris AIR & COSMOS 6 Dec 86)

USSR REPORT: SCIENCE AND TECHNOLOGY POLICY

ITALIAN SCIENTISTS VISIT SOVIET R&D CENTERS, DISCUSS JOINT RESEARCH

Members of several Italian research institutes who visited Soviet research centers discuss the administrative structure of these centers and examine the potential for joint Italian-Soviet research in materials and metallurgy. (Rome L'URSS TRA SCIENZA E INNOVAZIONE TECNOLOGICA 1986)

WORLDWIDE REPORT: EPIDEMIOLOGY

HUNGARIAN ZOONOSIS RESEARCH EXAMINED

Article discusses zoonosis research of Dr. Ferenc Kemenes, special advisor to the Phylaxia Vaccine Producing Enterprise, who has developed a serological test for tularemia and a leptospirosis vaccine and is testing a new vaccine against listeriosis. (Budapest UJ IMPULZUS No. 24, 29 Nov 86)

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